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Research Article

EFFECT OF *CALOTROPIS PROCERA* (MADAR) AND AMPROLIUM SUPPLEMENTATION ON GROWTH PERFORMANCE OF BROILERS DURING MIXED *EIMERIA* SPECIES INFECTION

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ABSTRACT

A feeding trial of 30 days duration was conducted on day-old, 168 broiler chicks to study the effect of 0.4% and 0.2% *Calotropis procera* (madar) leaf powder and 0.0125% amprolium supplementation on growth performance of broilers during mixed *Eimeria* species infection. **Chicks** were randomly divided into seven groups (I-VII), each with two replicates of 12 chicks. On 15th day of experiment, broilers of groups II, IV, VI and VII were infected by inoculating 1 ml suspension containing 50,000 sporulated oocysts of mixed *Eimeria* species. Average body weight and feed intake of broilers of each group were recorded on 5 days interval and body weight gain, feed intake, feed efficiency ratio and performance index were calculated. Among uninfected groups, growth performance was significantly higher in madar leaf powder supplemented birds as compared to controls whereas growth depressing effect of amprolium was noticed. Among infected groups, amprolium and 0.4% madar leaf powder ameliorated the negative effect of *Eimeria* spp. on growth performance. Hence, it is concluded that madar (*C. procera*) leaf powder has good potential to counter depression in growth performance in broiler chickens due to coccidioisis.

Keywords: Amprolium, coccidiosis, growth performance, madar leaf powder

Coccidiosis, one of the important diseases of poultry, is caused by *Eimeria* spp. The parasite multiplies in the intestinal tract and causes tissue damage resulting in diminished feed intake and nutrient absorption, reduced body-weight gain, dehydration, blood loss, increased susceptibility to other diseases and mortality. Control of coccidiosis in modern intensive poultry production is based on use of chemical coccidiostats in feed (Allen and Fetterer, 2002) but, prolonged use and misuse of such drugs may lead to the emergence of resistant strains.

Plant products, viz. phytobiotics or phytogenics, could provide an alternative means of coccidia control (Abbas *et al*., 2012). *Calotropis procera* (Madar) is a plant with antioxidant, antidiarrhoeal, anti-inflammatory, analgesic, antiulcer, antimicrobial, hepato-protective, and antiparasitic properties (Kumar *et al*., 2013). Looking to its medicinal properties, an experiment was conducted to study the effect of madar leaf powder or amprolium supplementation on growth performance of broilers infected with mixed *Eimeria* spp. infection.

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MATERIALS AND METHODS

One hundred sixty eight, one-day old commercial broiler chicks were randomly allocated to seven groups (I, II, III, IV, V, VI and VII). Each group had 2 replicates of 12 chicks each. Chicks were maintained under similar management conditions for 30 days. At the age of 5 and 12 days, vaccination against Ranikhet disease and Gumboro disease was done using F strain and Georgia strain, respectively. Feed and drinking water were provided *ad-libitum* during the entire experimental period. Coccidiostat free feed was procured from local market. Broilers of groups I and II were provided standard control diet without any supplementation. In groups III and IV, standard feed was supplemented with 0.0125% amprolium and groups V and VI were provided with diet supplemented with 0.2% madar leaf powder while in group VII diet was supplemented with 0.4% madar leaf powder. The experiment was undertaken after taking permission from Institutional Animal Ethics Committee.

At the age of 15 days, broilers of groups II, IV, VI and VII were infected by inoculating 1 ml suspension containing 50,000 sporulated oocysts of mixed *Eimeria*

species directly in the pharynx, using a long nozzled 2 ml plastic pipette. *Eimeria* spp. mixed culture contained *E. tenella* (80%), *E. necatrix* (10%), *E. acervulina* (6%), *E. maxima* (2%) and *E. mitis* (2%). Dose of sporulated oocysts was determined according to WAAVP guidelines (Holdswort *et al.,* 2004). Chicks of groups I, III and V were inoculated with 1 ml plain water. To assess the effect of amprolium and madar leaf powder on growth, different parameters such as feed intake, weight gain, feed efficiency ratio (FER) were calculated at 5 days interval in all groups. Performance index (PI) was calculated using following formula:

Performance Index (PI) = Weight gain (gm) × Feed efficiency ratio

The data were statistically analysed using one way ANOVA technique (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The treatment means of weight gain, feed intake, feed efficiency ratio and performance index of broilers of different groups during pre infection, post infection and overall experimental period *i.e.* 0-30 days are presented in Table 1. During 0-5 and 6-10 days of experiment, there was no significant effect of madar supplementation on growth performance of broiler chicks. Kumar (2011) also recorded non-significant effect of different herbal treatments on growth performance of broilers during first week of the experiment. During 11-15 days of experiment weight gain, feed intake, FER and PI were significantly higher in madar leaf powder supplemented groups than other groups (control and amprolium supplemented). During 0-15 days of experiment (pre infection period), highest weight gain was observed in group VII. Weight gain was significantly higher in groups V, VI and VII than groups I and II. Weight gain in groups III and IV was non-significantly lower than controls. The results agreed with those of previous reports who also recorded more weight gain with the aqueous extracts of madar leaves in rabbits (Shahat and Shihata, 2012). Feed intake was appreciably higher in broilers of groups V, VI and VII than groups I and II and was maximum in group VII and the lowest in groups III and IV. Significantly higher ($P \leqslant 0.05$) FER was recorded in group VII than other groups. PI was significantly higher in groups V, VI and VII than control groups (I and II) and was the lowest in groups III and IV. Concentration dependent effect of madar leaf powder on improvement of PI was observed as group VII had significantly higher PI than groups V and VI.

Among uninfected groups growth performance was maximum in broilers of group V followed by groups I and III. The findings are consistent with the previous report of Giannenas *et al.* (2003). Similar to our study, Bahadhoran *et al.* (2014) also observed that the growth performance was significantly reduced in broilers of coccidia uninfected and amprolium fed group than uninfected non-supplemented group. Growth performance was significantly higher in respective uninfected groups than infected groups. In all infected groups *i.e.* groups II, IV, VI and VII growth performance was lower than group I and was the lowest in group II. Singh *et al.* (2008) and Kumar (2011) also reported that coccidial challenge significantly ($P<0.05$) affected the growth performance in infected chicks. Among infected and amprolium or madar leaf powder supplemented groups *i.e.* group IV, VI and VII, there was excellent activity of amprolium against coccidial infection as maximum growth performance was noticed in group IV. Similar observations were noted by Bozkurt *et al.* (2013) and Bahadhoran *et al.* (2014). The growth performance in groups VI and VII was lower than that in group IV but was significantly higher than group II. The effect of madar leaf powder in restoration of growth performance was concentration dependent as birds of group VII had better growth performance than group VI. Singh *et al.* (2009) also found better growth performance in madar aqueous solution supplemented broilers than control infected broilers.

During 0-30 days of experiment, growth performance parameters were higher in respective uninfected groups than infected groups and was lower in all infected groups than group I. Weight gain among the non-infected groups was maximum for group V (1416.35 gm) followed by group I (1314.31 gm) and minimum for group III (1258.94 gm). Feed intake was significantly higher in group V than group I and was minimum in group III. The FER was the highest for group V and the lowest for group III. PI was significantly ($P \leqslant 0.05$) higher in group V followed by groups I and III.

Among infected groups highest weight gain was observed in broilers of group IV which was non-significantly higher than that in group VII Weight gain was the lowest in group II. Feed consumption of group VII was found to be the maximum but non-significantly different from that in group IV. FER was the highest in group IV and the lowest in group II. PI was significantly lowest in group II and was the highest in group IV; however, the difference was non-significant when compared to group VII. Overall growth performance indicated that supplementation of 0.4% madar leaf powder and subsequent challenge resulted in similar growth performance with no statistical difference as obtained in amprolium supplemented and subsequently challenged group. This non-significant difference may

Table 1
Growth performance of broiler chickens of different treatment groups at different intervals (mean±sd)

Days/DPI	Parameters	I (UC)	II (IC)	III (UA)	IV (IA)	V (UM)	VI (IM-1)	VII (IM-2)
Pre infection period								
0-5	Weight gain (g)	70.72±0.56	68.88±1.38	69.22±0.73	69.12±1.88	71.22±0.48	71.05±1.62	71.63±1.80
	Feed intake (g)	83.56±2.12	81.52±2.44	84.18±3.93	83.91±1.31	85.50±2.34	85.48±3.47	82.51±1.27
	FER	0.846±0.014	0.845±0.008	0.822±0.030	0.824±0.035	0.833±0.017	0.831±0.014	0.868±0.008
	Performance index	59.83±0.57	58.20±0.58	56.90±4.28	56.95±6.82	59.33±0.81	59.04±0.30	62.17±2.17
6-10	Weight gain (g)	102.44±1.73	102.88±2.86	102.22±2.09	100.82±2.30	102.62±4.61	103.05±1.62	106.55±1.13
	Feed intake (g)	116.34±4.96	118.18±0.26	117.86±4.04	113.55±3.31	116.92±1.58	118.34±3.40	119.31±0.52
	FER	0.881±0.022	0.871±0.026	0.867±0.012	0.888±0.005	0.878±0.027	0.871±0.011	0.893±0.006
	Performance index	90.25±0.78	89.61±5.18	88.62±0.58	89.53±1.47	90.10±6.87	89.76±0.25	95.15±1.61
11-15	Weight gain (g)	140.17±1.18^{c}	141.16±2.59^{c}	133.00±7.54^{c}	137.67±2.83^{c}	158.66±0.94^{b}	159.00±1.42^{ab}	166.50±0.24^{a}
	Feed intake (g)	217.38±4.47^{b}	212.66±5.98^{bc}	199.49±3.01^{d}	204.70±3.07^{cd}	232.68±1.42^{a}	230.98±2.19^{a}	238.39±1.08^{a}
	FER	0.645±0.007^{e}	0.664±0.006^{cde}	0.667±0.027^{bcde}	0.673±0.004^{abcd}	0.682±0.001^{abc}	0.688±0.001^{ab}	0.698±0.004^{a}
	Performance index	90.41±0.34^{b}	93.73±0.82^{b}	88.71±8.71^{b}	92.65±2.42^{b}	108.21±0.62^{a}	109.39±0.91^{a}	116.22±0.87^{a}
0-15	Weight gain (g)	313.32±4.24^{c}	311.92±4.08^{c}	304.44±3.34^{c}	307.61±1.36^{c}	332.50±1.05^{b}	333.10±5.23^{b}	344.67±6.79^{a}
	Feed intake (g)	417.28±1.63^{b}	412.36±3.26^{b}	401.54±2.89^{c}	402.16±1.06^{c}	435.10±2.18^{a}	434.80±9.07^{a}	440.21±1.83^{a}
	FER	0.751±0.002^{b}	0.756±0.003^{b}	0.758±0.009^{b}	0.765±0.005^{b}	0.764±0.011^{b}	0.766±0.005^{b}	0.783±0.002^{a}
	Performance index	235.30±0.88^{c}	235.81±4.18^{c}	230.77±7.69^{c}	235.32±2.77^{c}	254.04±6.19^{b}	255.15±1.69^{b}	269.88±0.64^{a}
Post infection period								
16-20 /	Weight gain (g)	310.33±1.41^{b}	179.84±0.23^{g}	294.34±1.88^{c}	282.5±0.24^{d}	351.5±0.70^{a}	247.93±2.27^{f}	260.44±1.12^{e}
0-5	Feed intake (g)	497.27±2.75^{b}	385.76±1.22^{e}	484.97±2.38^{c}	480.34±2.10^{c}	539.93±1.83^{a}	446.47±3.18^{d}	450.49±1.33^{d}
	FER	0.624±0.001^{b}	0.466±0.002^{g}	0.607±0.001^{c}	0.588±0.003^{d}	0.651±0.001^{a}	0.555±0.001^{f}	0.578±0.001^{e}
	Performance index	193.65±0.66^{b}	83.81±0.49^{g}	178.66±1.56^{c}	166.11±0.94^{d}	228.83±0.03^{a}	137.60±1.44^{f}	150.53±0.83^{e}
21-25 /	Weight gain (g)	338.83±0.71^{b}	213.50±4.48^{g}	324.50±3.07^{c}	317.17±1.18^{d}	366.00±0.47^{a}	282.67±1.41^{f}	301.50±0.24^{e}
6-10	Feed intake (g)	540.34±2.27^{b}	415.55±7.35^{f}	512.25±1.44^{c}	495.23±2.23^{d}	550.51±1.23^{a}	485.49±1.07^{e}	499.89±3.32^{d}
	FER	0.627±0.001^{c}	0.514±0.002^{f}	0.633±0.008^{bc}	0.640±0.001^{b}	0.665±0.002^{a}	0.582±0.004^{e}	0.603±0.003^{d}
	Performance index	212.45±0.01^{b}	109.74±2.67^{f}	205.41±4.47^{c}	202.99±0.60^{c}	243.39±1.16^{a}	164.51±2.01^{e}	181.80±0.92^{d}
26-30/	Weight gain (g)	351.83±7.78^{b}	232.50±4.00^{f}	335.67±1.89^{c}	326.66±0.48^{d}	366.34±0.41^{a}	308.67±0.39^{e}	321.50±0.24^{d}
11-15	Feed intake (g)	543.01±2.38^{b}	437.13±2.41^{g}	523.68±0.08^{c}	515.52±1.82^{d}	558.86±1.24^{a}	502.76±2.14^{f}	509.79±0.66^{e}
	FER	0.648±0.011^{ab}	0.532±0.006^{e}	0.641±0.004^{bc}	0.634±0.003^{c}	0.656±0.001^{a}	0.614±0.002^{d}	0.631±0.001^{c}
	Performance index	227.99±9.08^{b}	123.69±3.58^{f}	215.16±2.39^{c}	207.10±1.33^{cd}	240.32±0.09^{a}	189.52±0.22^{e}	202.87±0.56^{d}
16-30/	Weight gain (g)	1000.99±9.89^{b}	625.84±8.25^{g}	954.50±6.84^{c}	926.33±0.47^{d}	1083.84±0.71^{a}	839.27±0.39^{f}	883.44±1.60^{e}
0-15	Feed intake (g)	1580.61±7.40^{b}	1238.43±10.9^{g}	1520.90±1.02^{c}	1491.09±6.16^{d}	1649.30±4.30^{a}	1434.71±2.12^{f}	1460.16±4.00^{e}
	FER	0.633±0.003^{b}	0.505±0.002^{g}	0.628±0.004^{c}	0.621±0.002^{d}	0.657±0.001^{a}	0.585±0.001^{f}	0.605±0.001^{e}
	Performance index	633.63±9.81^{b}	316.05±5.45^{g}	599.43±7.67^{c}	575.25±1.67^{d}	712.08±1.06^{a}	490.97±0.23^{f}	534.48±0.97^{e}
Overall growth performance								
0-30	Weight gain (g)	1314.31±9.90^{b}	937.76±12.3^{f}	1258.94±0.66^{c}	1233.94±0.89^{d}	1416.35±3.90^{a}	1172.37±4.27^{e}	1228.11±2.02^{d}
	Feed intake (g)	1997.88±9.03^{b}	1650.79±14.2^{f}	1922.43±1.86^{c}	1893.25±7.23^{d}	2084.39±2.12^{a}	1869.51±6.95^{e}	1900.37±5.84^{d}
	FER	0.658±0.001^{b}	0.568±0.002^{f}	0.655±0.001^{bc}	0.652±0.002^{c}	0.680±0.001^{a}	0.627±0.001^{e}	0.646±0.001^{d}
	Performance index	864.82±9.29^{b}	532.65±9.65^{f}	824.61±2.21^{c}	804.53±4.07^{d}	963.12±3.65^{a}	735.08±2.68^{e}	793.36±0.44^{d}

Means bearing different superscripts in a row differ significantly (P≤ 0.05). UC= Uninfected control; IC= Infected control; UA= Uninfected amprolium treated; IA= Infected amprolium treated; UM= Uninfected madar treated; IM-1= Infected madar treated (0.2%); and IM-2= Infected madar treated (0.4%)

be due to anticoccidial activity of madar (Kshirsagar *et al.*, 2008; Das *et al.*, 2009).

Growth performance was significantly higher in madar leaf powder supplemented uninfected group than other groups. This may be attributed to the presence of flavonoids, phenols and saponin in its leaf (Zaman *et al.,* 2011; Kumar *et al*., 2013; Tiwari *et al.,* 2014). Flavonoids and phenols contribute to the antioxidant potential of *C. procera* leaf powder, whereas saponins have the strong surfactant activity thus they reduce the superficial tension of fluids and allow better absorption of nutrients from intestine and help in better weight gain (Joshi *et al.,* 2009; Zaman *et al.,* 2011). Growth depressing effect of amprolium supplementation was noticed. Probable reason for this growth depression may be the reduction in the thickness of duodenum and jejunum lamina propria which result in diminished intestinal secretions in these segments of intestine in chickens. Reduction in villous length, width and surface area in the duodenum, jejunum and ileum probably also depressed growth in amprolium supplemented uninfected broilers.

Growth performance of broilers after *Eimeria* infection was reduced in infected groups than respective uninfected groups. It might be due to destruction of the absorptive mucosal surface and competition for micronutrients by *Eimeria* spp. thereby resulting into metabolic imbalances and adversely affecting nutrient utilization. Amprolium was more efficient than madar in ameliorating the growth performance reduction due to coccidiosis because amprolium affects the second generation schizonts in the life cycle of *Eimeria* sp. (Bozkurt *et al.,* 2013). It was noticed that when the coccidial infection was introduced into the flock, the growth depressing effect of amprolium was neutralized by the effective control of the infection. Higher growth performance of madar leaf powder supplemented and *Eimeria* infected birds than control infected birds may be due to saponin, which acts on the protozoan development by interacting with cholesterol present on the parasitic cell membrane and resulting into parasitic death (Wang *et al.,* 1998) and phenols and flavonoids which minimize *Eimeria* induced damage to the intestinal wall during pro-inflammation reaction resulting in less damage to the gut and improved nutrients absorption (Bozkurt *et al.*, 2013). Mahmoud *et al.* (2001) and Zaman *et al.* (2011) also noticed anticoccidial property of *C. procera.* It is concluded that amprolium has excellent activity to prevent growth reduction caused due to coccidiosis and madar (*C. procera*) leaf powder also has comparable effect as amprolium. Hence, madar leaf powder may also be used for the reduction of economic losses due to mixed *Eimeria* spp. infection prevalent in field conditions.

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